REMARKS

In the amendments above, Claims 1, 25, and 29 have been amended to more particularly point out and distinctly claim Applicant's invention.

Applicant wishes to thank the Examiner for a personal interview with Applicant's representatives to discuss the above application and the outstanding Office Action. The results of said interview, in which cited references and proposed amendments to the claims were discussed, is set forth and an Examiner Interview Summary Record dated October 8, 2004.

Claims 1-12, 24-28, and 30-40 have been rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner's attention is directed to the amendments above, wherein Claims 1, 25 and 29 have been amended. It is believed that said amendments overcome the basis of this rejection.

Claims 25-28, 30, 31, and 35-40 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Hongo et al. '759 ("Hongo") and Haight et al., "MARS: Femtosecond Laser Mask Advanced Repair System In Manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) ("Haight") in view of Gelbert et al. '818 ("Gelbert"); Claims 25-28, 30-32, and 35-40 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Hongo, Haight, and Gelbert; and in view of Lou et al. '272

("Lou"). Claims 1-4 and 9-18 have been rejected under U.S.C. §103(a) as being unpatentable over Hongo and Haight in view of Gelbert; Claims 1-4, 9-12, 24-31, and 35-40 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Hongo, Haight, and Gelbert in view of Zhang et al., "Study Of Microprocessing Of Glass...", Proc. SPIE vol. 3933 pp. 332-337 ("Zhang"), Okamoto '606 ("Okamoto"), Hayahsi '683 ("Hayashi"), alone, and further in view of Lou; and Claims 25-28 and 30-40 have been rejected under 35 U.S. C. §103(a) as being unpatentable over James et al. '200 ("James") combined with Hongo, Haight and Gelbert in view of Jensen et al. '718 ("Jensen"). Further, Claims 1-4, 6-12, 24-31, and 33-40 have been rejected under 35 U.S.C. §103(a) as being unpatentable over James combined with Hongo, Haight, Gelbert, and Jensen in view of Zhang, Okamoto, Ito JP 2000-056112, and Hayashi.

Applicant respectfully traverses the above rejections.

Hongo teaches the processing of photomasks to remove defects where the laser beam passes through the transparent substrate. However, the backside irradiation described herein is of nanoseconds duration, which is five orders of magnitude greater than femto-second lasers' technology. In atomic relaxation times, nanoseconds time durations are considered as nearly continuous, and therefore constitute a completely different field.

The slight reduction of thermal effects at below 20 nanoseconds is known to be orders of magnitude larger than femto-seconds' laser induced damage zones, and that is well described in Haight.

Moreover, in contrast to Haight, where a method of ablation of chrome by femto-second laser describes the laser beam as being focused in air, and in accordance with the present invention, focusing a laser radiation through transparent media is accompanied by The Kerr effect with self-focusing inside the substrate. A damage zone inside quartz or fused-silica is created by nearly ten-fold more laser energy then what is required to ablate chrome off a surface.

Therefore, by reducing energy considerably, to a level of tens of nanojoules, at focus, no intra-volume scattering center is created on one hand, but a self-focusing which results in surface ablation microns away from focal plane, results on the other hand. Such self-focusing leads to the possibility of directing the laser beam many microns away from surface target, and achieving the desired pattern, with less debris and better control of damage zone size and shape.

Gelbert teaches ablation of coating material to form phase shift elements. More particularly, Gelbert proposes making slight physical modifications to the edges of the pattern by removing coating material in a predetermined manner to cause phase shifting (and to compensate for edge effects). In contrast, this application teaches intra-volume

damage zone as a means to form phase shift masks. Phase shift elements are introduced inside the substrate itself, with no ablation. The proposed optical elements form scattering centers within the transparent media.

Zhang and Okamoto teach ablation of material or coating to form phase shift elements, wherein the pattern is physically altered to obtain the phase shift effect. In contrast, the present application teaches intra-volume damage zones as a means for forming phase shift masks. Phase shift elements are introduced inside the substrate itself, with no ablation.

Ito (a newly referenced document – JP 2000-056112) deals with writing three-dimensional diffractive elements within a transparent medium. In this respect Applicant is aware of much earlier publications relating to intravolume writing in glass and other transparent media (Most notable: a series of papers published by Harvard University Group, Department of Physics, during the years 1996-2000, led by Chris B. Shaffer, Eli N. Glezer and Eric Mazur. See also, for example, U.S. Patent No. 5,206,496 to Clement, disclosing sub-surface marking, producing an image – which is in fact a reflective element within the glass or other transparent material.)

Applicant urges that providing phase shifting formation within the substrate of a mask (independent Claim 25) is novel and unobvious and certainly patentable in view of Hong, Height, Gelbert, and/or Ito.

The provision of phase shifting is aimed at refining the pattern projected using a mask. The projected pattern is of course determined by the pattern inscribed on the mask itself, yet phase shifting elements can refine the projection and obtain better details, better printed contrast, greater resolution and therefore better overall performance.

Up until now phase shift formation was used only on the coating or surface of the mask, in the form of physical grooves provided on the coating surface (MoSi) or on glass surface itself. This was proved to be satisfactory but not good enough of extra-fine details. The fact that three-dimensional formations may be used also plays a role in making this a superior way of treating masks and refining their projected patterns. Three-dimensional structures widen the process window by adding one more dimension to phase control.

Phase shift on its own is not new, nor is using it in the mask industry (in the form of physical grooves on the coating layer or glass surface). Yet, the present invention has brought about intravolume phase shift formations, which are superior to phase shift grooves, and which results in a higher yield process. This method is not merely a substitute for surface grooves – it is substantially better and more efficient since it is a single process, unlike physical grooves which involve processing in up to 5 stages (lithography). In fact, ever since Applicant has disclosed this technique to the industry, great interest in this technique has been shown by big players in the industry. It is understood that such interest has been shown because the novel technique produces

results that are clearly much more superior and higher yield than the old physical grooves techniques.

The Examiner also cited some references that pertain to incidental features (anti-reflective coating as mentioned in Lou '272, splitting the laser beam, as mentioned in Jensen '718, etc.). However, Applicant does not believe it is necessary to discuss matters that are the subject of dependent claims at this time.

The method disclosed in the present invention would definitely not be obvious to a person skilled in the art familiar with Hongo, Haight, Lou, Gelbert, Zhang, and Okamoto. It should be noted that Claim 1 explicitly refers to the use of "ultra-short" laser irradiation.

In sum, the claims herein are not unpatentable under §103(a) over any reference or combination of references cited by the Examiner, and the rejections under §103(a) should be withdrawn.

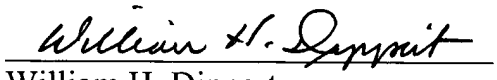
The references and the invention were, as mentioned above, discussed at the personal interview. Consistent with said discussion Applicant has prepared a Declaration under 37 C.F.R. §1.132 by Eitan Zait, which Declaration is attached hereto. Mr. Ziat describes certain testing that was carried out, including copies of the results to support Applicant's position that the invention herein is novel and unobvious in view prior art such as that cited by the Examiner.

Should the claims herein be allowable but for a matter that could be the subject of an Examiner's Amendment or a supplemental submission, Applicant would appreciate the Examiner's contacting Applicant's undersigned Attorney of record.

Reconsideration and allowance of all the claims herein are respectfully requested.

Respectfully submitted,

December 20, 2004



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